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ECONOMIC CONSEQUENCES OF MISPREDICTING UTILITY

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Abstract: Individuals make systematic mistakes in their decisions, because they mispredict utility from choice options. When deciding, extrinsic attributes of choice options are more salient than intrinsic attributes. Adaptation is neglected, recollection of feelings is distorted, decisions are rationalized and wrong intuitive theories of happiness are applied. People overestimate extrinsic attributes and therefore put too much emphasis on acquiring income and gaining status. In contrast, they underestimate intrinsic attributes and devote too little time to their family, friends or hobbies, which lowers their utility level. The theoretical analysis is consistent with an econometric study on commuting decisions using reported subjective well-being data.

JEL classification: A12, D11, D12, D84, I31, J22

Keywords: adaptation, extrinsic/intrinsic attributes, individual decision-making, misprediction, subjective well-being, time allocation

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Economic Consequences of Mispredicting Utility

I. The Issue

Consider a job offer promising an increase in income of \$ 30,000 a year, but which is farther away from where you live. Due to longer commuting time, you will have less time available for your family, friends and hobbies, gardening and dancing. How will you decide?

We argue and present empirical evidence that individuals systematically underestimate the utility relating to aspects of consumption satisfying intrinsic needs (time spent with family and friends or on hobbies). In contrast, the characteristics relating to consumption satisfying extrinsic desires (income and status) are overvalued. As a consequence, individuals tend to under-consume goods and activities with strong intrinsic attributes compared to those with strong extrinsic attributes. According to their own subjective evaluation, individuals make distorted decisions when they choose between different options and obtain a lower utility level than they otherwise would. Individuals find comparisons between attributes, whose salience shifts over time, difficult to make, so that learning is hampered and sometimes does not occur at all.

This paper focuses on predicting utility involved in individual decisions. We advance four specific propositions:

- (1) It is useful to distinguish between the “intrinsic” and “extrinsic” attributes of options, like goods and activities.
- (2) The future utility of the intrinsic attributes of goods and activities is underestimated when making a decision, compared to the utility of the extrinsic attributes.
- (3) Goods and activities characterized by strong intrinsic attributes are under-consumed compared to those with strong extrinsic attributes.
- (4) According to the individuals’ own evaluation, the distorted decisions lower their utility.

Section II discusses individual decision-making, when the salience of the characteristics of goods and activities differs between the moment when people make a decision and the consumption period. Section III provides reasons why the intrinsic attributes are undervalued compared to the extrinsic attributes, drawing on both psychological and institutional insights.

The following section IV analyzes the consequences of such misprediction for behavior and utility. Section V provides an econometric analysis for a specific, but important example; the job offer discussed at the outset. Section VI draws concluding remarks.

II. Individual Decision-Making When the Salience of Attributes Changes

Standard economic theory assumes that individuals are able to compare the future utilities provided by the goods and activities consumed. They maximize their own utility in a rational consumption decision. In certain cases, it has proved useful to distinguish between the various characteristics of goods and activities (Lancaster 1966, Becker 1965) or the attributes of options (e.g. Keeney and Raiffa 1976). However, this differentiation is not taken to affect the evaluation of future utility. The utility of a chosen combination is simply the sum of the weighted value of each characteristic.

The standard economic model of consumer decisions is appropriate for most goods and activities and for most situations. It is also appropriate when individuals make random prediction errors, or when the extent of misprediction is the same for *all* goods and *all* activities.

This paper diverges from these assumptions: we argue that there are *systematic* differences in mispredictions between two types of attributes characterizing various options.¹

- Attributes of the first type relate to ‘intrinsic needs’. A comprehensive view of three main aspects of intrinsic needs is provided in the self-determination theory of Deci and Ryan (e.g. 2000). First, there is a need for relatedness, referring to the desire to feel connected to others through love and affection (having a family, friends and being in a social setting). Second, a need for competence refers to the propensity to control the environment and experience oneself as capable and effective. Third, a desire for autonomy involves the experience of being in charge of one’s actions or being causal.² Intrinsic need

¹ We borrow these categories from a large literature in humanistic or value psychology (e.g. Maslow 1968, Rogers 1961).

² The underlying theories are manifold, and comprise, for instance, people’s urge to master their environment for its own sake (White 1959), of being an origin (DeCharms 1968), people’s resistance to loss of control (Brehm 1966) and the reflection of perceived control in more effective behavior and higher positive affects (Bandura 1977, Seligman 1992).

attributes are also characterized by providing “flow experience” (Csikszentmihalyi 1990), i.e. when one is completely immersed in an activity, often a hobby.

- The second type of attributes relates to ‘extrinsic desires’. Extrinsic attributes serve people’s goals for material possessions, fame, status or prestige. Income thus becomes a crucial aspect of options in the choice set. A high income is a necessary prerequisite for a high standard of living in material terms.

Each option, activity and even good is multidimensional; in general, a particular choice alternative has both intrinsic and extrinsic need attributes or, in short, intrinsic and extrinsic attributes. But some goods and activities have a stronger component of an intrinsic nature (e.g. time spent with friends)³, others of an extrinsic nature, like consumer articles that go beyond basic material needs (e.g. designer clothes). In this analysis, we thus neglect the satisfaction of physiological needs but concentrate on need satisfaction through time and income that is available for discretionary use.

Our main proposition is that, when *making a decision*, the extrinsic attributes are relatively more salient than the intrinsic attributes of different options. Individuals therefore tend to undervalue future utility from the intrinsic attributes relative to the extrinsic attributes when deciding. This distortion leads to a systematic discrepancy between predicted and experienced utility.⁴

III. Why Intrinsic Attributes Are Undervalued When Predicting Utility

1. Four Sources

The following major sources of origin for underestimating future utility from intrinsic attributes compared to extrinsic attributes of goods and activities can be deduced:

³ When people spend time with friends because they are famous or important, the extrinsic dimension becomes more prevalent.

⁴ Both utility measures – predicted and experienced utility – diverge from traditional decision utility that is derived from individual behavior. Utility is rather understood as a hedonic experience (see Kahneman, Wakker and Sarin 1997).

(1) *Adaptation is underestimated*

There is convincing empirical evidence that individuals are not good at foreseeing how much utility they will derive from their future consumption (e.g. Loewenstein and Adler 1995). For an extensive survey, see Wilson and Gilbert (2003).⁵ Research on affective forecasting shows, e.g., that people overestimate their reactions to specific events because they are embedded within other daily life events that they are not currently aware of: for instance, seeing one's favorite soccer team winning is experienced simultaneously with other events occurring in the environment. Another example for errors in predicting emotions is that people underestimate their ability to successfully cope with negative events.⁶ The general insight is that people usually have biased expectations about the intensity and duration of emotions, in the sense that the emotional impact is often lower than predicted because people adapt more than they foresee.

We argue that adaptation is more likely to be underestimated for extrinsic aspects than it is for intrinsic aspects. People adapt less to goods and activities with strong intrinsic components because the (positive) experience tends to be renewed with every new act of consumption. Getting together with a good friend is always rewarding, and one does not get used to it in the sense of valuing this experience less and less. Rather, the opposite is true. Each interaction with the friend provides fresh pleasure and enjoyment. Similarly, many scholars have a flow experience when they immerse themselves in writing a paper or book they always wanted to do. The corresponding utility does not wear off. Thus, many senior scholars, who have written

⁵ Standard research designs are prospective longitudinal studies about self-reported emotions. People are asked how happy they expect themselves to be after some event has happened or some option has been chosen. These predictions are then compared with reported subjective well-being when actually experiencing the new situation. There are several limits to this design: (i) Usually only predictions for changes in the near future are assessed. (ii) The way in which scales of measurement are interpreted can change over time, e.g., due to maturation or a change in the anchor. (iii) Predictions might also affect actual feelings or even become self-fulfilling prophecies. Some of these problems can be eliminated by conducting studies between subjects, where one group's predictions are contrasted with a different group's actual reports.

⁶ Young academics might be particularly worried about life after a negative tenure decision. Gilbert et al. (1998) asked assistant professors how happy they would be after a positive and a negative tenure decision. The answers were compared with the reported subjective well-being of academics affected by a tenure decision made five or less years previously. Although assistants predicted they would be less happy during the first five years after being turned down, there was no statistically significant difference between those who had and had not gotten tenure. Similarly, assistants also overestimated the positive impact of receiving tenure on their subjective well-being.

numerous papers and books in the past, experience flow to the same extent as when they were young.

The differential effect on the intrinsic and extrinsic attributes of goods and activities is consistent with much recent empirical evidence (for a survey, see Frederick and Loewenstein 1999). It has been found that individuals do not adapt their utility evaluation in the case of undesirable experiences that inhibit intrinsic need satisfaction. In particular, severe health problems, like chronic illness, or illness that gets progressively worse, reduces autonomy and leads to lasting reductions in reported subjective well-being (e.g. Easterlin 2003). Widowers suffer, on average, for years from their lot (e.g. Stroebe et al. 1993). Having a job is related to many aspects that provide flow experiences and satisfy intrinsic needs, like being in the company of workmates, applying expertise and experiencing autonomy. Accordingly, being unemployed is repeatedly found to have high negative non-pecuniary effects on people's subjective well-being, with little habituation (Clark et al. 2001). By way of contrast, having a job with a high degree of autonomy, as in the case of self-employed people, is related to high job satisfaction. Frey and Benz (2002), e.g., show that the self-employed derive more utility from their work than people employed by an organization, irrespective of income earned or hours worked. Moreover, they can explain this difference with people's evaluation of the use of initiative at their work place and their satisfaction with the actual work itself (p. 25). Intrinsic attributes also characterize the work of volunteers. It is, in fact, found that people doing volunteer work are more satisfied with their life in general, even when taking the possibility of reverse causality into account (Meier and Stutzer 2004).

In contrast, there is empirical evidence that individuals experience a considerable extent of adaptation in the case of goods and activities in which the extrinsic aspects are dominant. This has, in particular, been demonstrated in the case of income (van Praag 1993, Easterlin 2001, Stutzer 2004). When individuals experience a rise in income, their utility level at first increases but, after a year or so, most of this beneficial effect has evaporated. It has been estimated (van Herwaarden et al. 1977) that around 60% of the utility increase due to a higher position in the income distribution disappears over time.

The evidence of little or no adaptation for goods and activities characterized by intrinsic aspects, and strong adaptation for those characterized by extrinsic aspects, suggests that individuals who underestimate adaptation, or even disregard adaptation altogether, tend to make a bigger mistake when predicting future utility from extrinsic attributes than from intrinsic attributes.

(2) *Distorted memory of past experiences*

When individuals make decisions about future consumption, or allocation of time, when information from current experience is absent, they have to resort to their respective experiences in the past. People reflect on specific moments from the past or access generalizations about likely emotions in a particular type of situation (for a discussion, see Robinson and Clore 2002). If specific information is available, it has priority in people's judgment. Thereby, the more memorable moments of an experience disproportionately affect retrospective assessments of feelings (Kahneman 1999). What counts as "more memorable" tends to be the most intense moment (peak) and the most recent moment (end) of an emotional event. This peak-end rule or duration neglect has been established in many experimental tests (Kahneman 2003).

We propose that intrinsic attributes relate to long-term experiences of moderate but enduring positive feelings. In order to be subject to the renewed enjoyment of the type of interactions mentioned above, as well as to be able to immerse oneself in a flow experience, time is needed. In contrast, extrinsic attributes are related to short-term experiences, in particular peak emotions. As a result, we argue that the intrinsic aspects of goods and activities related to duration (compared to the extrinsic aspects related to peaks) are underestimated when people predict utility based on retrospection.

(3) *Rationalization of decisions*

Individuals have a strong urge to justify their decisions, both to themselves and to other persons (for pre-decision justification, see Shafir et al. 1993). It is not only predicted consumption utility that affects, e.g., the decision to buy something, but also whether people think that they are getting a bargain (Thaler 1999). There is a general tendency to resist affective influences and to take rationalistic attributes into account when making decisions. Hsee et al. (2003) call this reason-based choice "lay rationalism". In experiments, they find, e.g., that people focus their decisions on absolute economic payoffs and play down non-economic concerns. Other experiments find that people emphasize aspects of events that are easy to articulate and neglect aspects that are important for experience when they are asked to give reasons during the phase of decision-making (e.g. Wilson and Schooler 1991). Similarly, people seem to base their choices on rules and principles and bypass predictions on the experiential consequences of their choices (e.g. Prelec and Herrnstein 1991). These arguments

imply, however, that people do not optimally consider various attributes of different options so that predicted utility would be maximized.

We argue that, for extrinsic and intrinsic attributes, there is a similar inconsistency when it comes to decision-making. It is much easier to provide rationalistic justifications for extrinsic than for intrinsic characteristics. Consider again the job offer providing more income but less leisure-time. Most people will find it much easier to justify both to themselves and to others why they should accept the job offer, as the extrinsic monetary dimension is salient. In contrast, it is quite difficult to justify why the intrinsic characteristics provided by more leisure-time (even when its hedonic utility might be correctly predicted) are important enough to refuse the large increase in money. As a result, goods and activities characterized by strong intrinsic attributes tend to enter decisions with too little weight compared to extrinsic components.

(4) *Intuitive theories about the sources of future utility*

People have very diverse intuitive theories about what makes them happy (for a discussion see Loewenstein and Schkade 1999). These beliefs have a direct influence on people predicting future utility and it can cause them to err. Moreover, these beliefs play a role, because they shape the reconstruction of past emotions and make them consistent with current self-conceptions or beliefs (Ross 1989). Thus, intuitive theories interact with the three previously discussed sources of misprediction.

An important belief refers to acquisition and possession as central goals on the path to happiness, i.e. to materialism (e.g. Tatzel 2002 for a discussion in economics). It is found that people with material or extrinsic life goals report lower self-esteem and life satisfaction than people with intrinsic life goals (e.g. Kasser and Ryan 1996, Sirgy 1997). This correlation is probably partly due to confounding unobserved personality traits and reversed causality due to a compensatory reaction of people with low subjective well-being. However, it might also indicate that people who believe intuitively in extrinsic attributes are prone to mispredict future utility. In contrast, people with intrinsic life goals for personal growth, relationships and community spirit apply intuitive theories that emphasize intrinsic attributes that lead to fewer mispredictions in future utility. Our argument thus includes heterogeneity among individuals that leads to additional testable predictions when combined with previous reasons for misprediction.

2. Institutional Conditions

The differential effect of misprediction between intrinsic and extrinsic attributes also depends on the extent to which the market enters into the matter. The monetarization of a good or activity induces individuals to focus more on extrinsic attributes than they otherwise would. This applies both to work and consumption. It has been argued that introducing pay for performance leads employees to regard those performance aspects, which are relevant for the compensation they receive, as dominant. In contrast, aspects of performance irrelevant to pay are crowded-out (see Frey 1997 and, for a survey of empirical evidence, Frey and Jegen 2001). In the area of consumption, advertising is often directed to extrinsic aspects of the goods to be sold. In comparison, lobbies for intrinsic values tend to be weak and sometimes do not exist at all. To the extent to which “commercialization” occurs (see e.g. Kuttner 1997, Lane 1991), individuals are induced to mispredict the future utility of goods. They are led to believe that the extrinsic characteristics will make them happier than is actually the case compared to the intrinsic characteristics.

3. Why is there little or no learning?

Systematically mispredicting future utilities, even if they differed between goods and activities, would be of little consequence for economics if individuals would learn quickly in repetitive choice situations.⁷ If this were the case, mispredicting would be a disequilibrium phenomenon, not basically affecting the notion of rational decision-makers maximizing individual utility.

A large literature suggests, however, that learning is a complex process, which does not necessarily lead to overcoming mispredictions. It is likely to do this if multi-dimensional goods and activities are reduced to essentially one dimension, which can be expressed in monetary terms. In that case, the individual can be expected to be able to rectify his or her mistakes to a greater extent within a short period of time. Standard economic models then apply fully.

In the choice situation considered here, where the importance of various attributes differ between the point of time when people have to make a decision and actual consumption time, learning is much more difficult. Learning, where decisions about future consumption are

concerned, must often be based on the reconstruction of past feelings. They are therefore subject to the same misperceptions as remembering the utility of past experiences (see previous section on distorted memory). Learning is particularly hampered when episodic memories become too few and people rely to a large extent on their intuitive theories (Robinson and Clore 2002). In consequence, remembered utility and predicted utility become similar and relatively independent of the utility actually experienced. Mitchell et al. (1997), for example, document this phenomenon in three survey studies about enjoyment predicted before, experienced during and recollected after a trip to Europe, a Thanksgiving vacation, and a bicycle trip in California. Although participants enjoy the actual trip less than predicted, they report enjoyment levels similar to the ones predicted before the trip when they recall the experience.

Learning, in contrast, is easier when people can access their feelings directly, i.e., while still experiencing a particular situation. It might even inspire them to adopt institutional preconditions to sustain optimal decisions after the event. Most readers will be familiar with the experience of not getting together with friends as much as we would really like when reflecting about it immediately after the meeting. It is just that we cannot imagine how enjoyable it was once we are back in our daily routine and have to find time in our busy schedules. One of us experimented with trying to overcome this particular problem by fixing a new date whilst still together with the friends and aware of the pleasures of being in the company of these friends. It resulted in getting together more frequently and enjoying the meetings to the same extent as before. There are also moments of pure bliss and very traumatic experiences that can abruptly change people's intuitive theories about what constitutes happiness.

In general, however, a more elaborate learning process is required. The individual must step back from his or her actual decision-making activity, where the extrinsic characteristics dominate over the intrinsic characteristics. He or she must attempt to make an overall evaluation, including undertaking some critical self-examination, or must resort to what has been called “double-loop learning” (see Argyris and Schön 1978). As such elaborate learning is more costly, and is in itself subject to errors, individuals are not able to fully correct their mispredictions within a reasonably short period of time. In many cases, they are even

⁷ In contrast, for choices made once-in-a-lifetime, learning is no option. Biased decisions can then well affect one's life path. We believe that misprediction of utility matters greatly in important life decisions (like career choice), but we have not studied them here.

incapable of making any correction, so that the misprediction of future utilities persists over time.

Limited learning can well co-exist with people's partial awareness of themselves or others mispredicting utility.⁸ Many people talk, for example, about their difficulties and mistakes in balancing their working life with their personal life. Yet, on a case-by-case basis, they still make decisions underestimating intrinsic attributes relative to extrinsic attributes.⁹

A more fundamental reason for people's limited learning might lie in some functionality of misprediction in the evolutionary process. Rayo and Becker (2004) model how humans' utility functions formed in order to maximize success in genetic replication. Their model rationalizes that people neglect adaptation (described as self-inflicted externality). However, in today's world, this utility function with an inbuilt misprediction is no longer helpful in guaranteeing an optimal mix between experienced utility and motivation for success in society.

IV. Testable Propositions

The mispredictions concerning future utility from goods and activities, depending on their intrinsic and extrinsic attributes, allow us to derive the following testable propositions:

- (1) Goods and activities with pronounced intrinsic attributes are *under-consumed* relative to those with pronounced extrinsic attributes.
- (2) The systematic distortions in allocation due to utility misprediction *reduce individuals' experienced utility* according to their *own* best interests.
- (3) Individuals identified as being more *materialistically* oriented are subject to *greater misprediction* errors than non-materialistically oriented individuals, who focus more on the intrinsic characteristics of choice options.

Our hypotheses link up to various strands of literature where similar phenomena have been identified:

⁸ Systematic differences between self-evaluation and the assessment of others' decisions is likely due to overoptimism (Weinstein 1981). Thus people are overly confident about their own ability to make the right decisions, while at the same time being aware that the average person mispredicts utility.

⁹ This argument is similar to the ones about sophisticated and naive people who are fully or not at all aware of their future self-control problem (for a discussion of self awareness see O'Donoghue and Rabin 2003).

- The aspect of underestimated adaptation to new situations has been neatly introduced in theoretical models of intertemporal decision-making (Loewenstein et al. 2003). Based on their model of projection bias, various phenomena can be modeled like, e.g., the misguided purchase of durable goods or consumption profiles with too much consumption early on in life. Misprediction of utility thus provides an alternative to seemingly irrational saving behavior that is usually addressed in a framework of individuals with self-control problems. In Loewenstein et al. (2003), however, there is no explicit modeling of differences in adaptation *across* goods, attributes of different options or people. Thus, the possible consequences of decision inconsistency on behavior and well-being are limited in their model.
- It has been argued that the “work-life” balance of individuals today is distorted. People are induced to work too much, and to disregard other aspects of life. This proposition has been forcefully put forward for the United States, where individuals are said to be “overworked” (Schor 1991). This is consistent with our hypothesis that individuals tend to focus too much on options characterized by strong extrinsic attributes, in particular income, compared to intrinsic attributes.
- Competing for status involves negative externalities and therefore too much effort is invested in gaining status and acquiring “positional goods” (Frank 1985, 1999). Such goods are characterized by very strong extrinsic attributes. In the saying “Keeping up with the Jones’s”, it is revealed that consumption is externally oriented. Thus, misprediction of utility is likely to magnify the distortions of competing for status in consumption.
- Procedural utility, i.e. the satisfaction derived from the process itself rather than from its outcome, relates to innate needs. The utility derived from a particular process contributes to competence, relatedness and autonomy, and is therefore closely related to the intrinsic attributes of goods and activities (see the survey by Frey, Benz and Stutzer 2004). According to our propositions, sources of procedural utility are likely to be underestimated in people’s decisions. Consistent with this idea, it has been empirically shown (Tyler et al. 1999) that, when making decisions, individuals tend to prefer institutions promising favorable outcomes. But *ex post* they state that they would have preferred an institution putting more emphasis on (just) procedures.
- There is a long tradition in economics arguing that individuals tend to focus too much on material goods and disregard goods providing non-material benefits (see Lebergott 1993,

Lane 1991). Most importantly, Scitovsky (1976) claimed that “comfort goods” are over-consumed compared to goods providing “stimulation”. The former are described as defensive activities, providing protection from negative affect. They have a strong extrinsic component, consisting of the consumer goods achieved through rapid productivity growth. In contrast, stimulation comes from creative activities providing novelty, surprise, variety and complexity. These aspects emphasize the renewal of pleasurable experiences as it is also emphasized for intrinsic attributes. Unlike our theory, stimulation is at a competitive disadvantage relative to comfort goods because there is a higher cost of access to them and consumers are myopic about the future benefits from stimulating activities.

V. Empirical Application: Commuting and the Choice Between Different Jobs and Different Places of Residence

1. Construction of the Empirical Test

We hypothesize that people systematically underestimate future utility from the intrinsic attributes of goods and activities compared to extrinsic attributes when they make decisions. When this hypothesis is applied to an individual’s choice between different jobs and different possible places of residence, he or she is expected to underestimate an important aspect, namely, commuting time. Time spent commuting is no longer available for spending time with friends and family members or indulging in one’s hobby.

The prediction of neoclassical economics – which assumes perfectly rational decisions by individuals – is taken as our reference standard. In standard economics, people have no difficulties optimizing when goods and activities have multiple characteristics. A characteristic like commuting is like any other characteristic. If it involves monetary costs and physical or mental stress¹⁰, they enter negatively into the evaluation and have to be offset by other characteristics, like income or lower housing costs. Only then a job offer involving a longer commuting time is expected to be chosen. This basic idea of compensation is the driving force behind the notion of equilibrium in urban location theory (e.g. Alonso 1964,

¹⁰ It is well documented that commuting is physically and mentally stressful (e.g. Novaco et al. 1990). The strain of commuting is associated with raised blood pressure, musculoskeletal disorders, lowered frustration tolerance and increased anxiety and hostility, being in a negative mood when getting to work and arriving home in the evening, increased lateness, absenteeism and turnover at work, as well as with adverse effects on cognitive performance (Koslowsky et al. 1995).

Moses 1962), as well as in public economic theory, based on Tiebout's (1956) model of fiscal competition between jurisdictions. Accordingly, commuting is determined by an equilibrium state of the housing and labor market, in which an individual's well-being or utility is equalized over all actual combinations of alternatives in these two markets.¹¹

This notion of equilibrium can be used for an empirical test. Following standard theory, commuters' utility is increasing in consumption c of goods, services and housing, and decreasing in the disamenity D for commuting time, $U=u(c,D)$, $u_c>0$, $u_D<0$.

Utility U is equal to \bar{U} for realized combinations of income y_i , time spent commuting D_i and rent r_i across individuals indexed by i

$$U_i = u(y_i, D_i, r_i) = \bar{U} \quad \forall i \quad (1)$$

Totally differentiating this equilibrium condition leads to

$$dU = \frac{\partial u}{\partial y} dy + \frac{\partial u}{\partial D} dD + \frac{\partial u}{\partial r} dr = 0 \quad (2)$$

For variation in commuting time D , this implies that

$$\frac{dU}{dD} = \frac{\partial u}{\partial y} \frac{dy}{dD} + \frac{\partial u}{\partial D} + \frac{\partial u}{\partial r} \frac{dr}{dD} = 0 \quad (3)$$

The left hand side of equation (3) states that the overall change in utility due to a change in the disamenity commuting time is zero. A decomposition of the total change is provided on the right hand side of equation (3). There are three effects of an increase in commuting time: there is a marginal gain in utility due to a higher level of consumption that is reached because jobs that require longer commutes offer a higher income. Moreover, longer commuting time reduces rents for housing and thus leaves additional money for consumption. Besides these two positive effects, there is a marginal decrease in utility due to the burden of spending more time commuting. Given that incomes and rents for housing exclusively reflect compensation for commuting conditions, the three effects add up to zero.

¹¹ The strong notion of equilibrium has only been partially tested so far. It has not been studied whether there are systematic rents: rather, derived hypotheses within the equilibrium framework have been analyzed. There is considerable evidence for capitalization of transportation infrastructure in the price of land and for compensating wage differentials due to commuting distance. However, these findings do not require an equilibrium situation, but can also be explained by the law of marginal substitution (e.g. Timothy and Wheaton 2001, van Ommeren 2000).

The prediction in equation (3) can be directly tested, provided utility is observable. We take commuters' reported satisfaction with life as a proxy measure for individual utility.¹² The idea for the empirical test is captured in the following regression equation

$$u_i = \alpha + \beta D_i + \varepsilon_i \quad (4)$$

The coefficient β measures the total change in utility due to a change in commuting time. Under the null hypothesis $\beta = 0$, commuting time is entirely compensated by either higher salaries or lower rents for housing. This is the prediction of standard economic theory, assuming full compensation of the cost of commuting by higher income and lower housing costs. The alternative hypothesis $\beta < 0$ states that commuting time is not fully compensated on the labor and housing market. $\beta < 0$ is predicted when commuters systematically underestimate the costs of commuting and accept jobs or choose housing that do not fully compensate them.

According to our theoretical propositions, misprediction of utility is supposed to differ between people. "Materialistic" people tend to have intuitive theories on happiness that emphasize the extrinsic aspects of goods and activities more than "non-materialistic" people. Thus, a second alternative hypothesis can be formulated, suggesting that the compensation indicated by coefficient β is less complete for people focusing more on extrinsic aspects, i.e. $\beta_M < \beta_{N-M} < 0$ (M indicating "materialists" and N-M "non-materialists").

2. Data

In order to perform the empirical test proposed in equation (4), information about people's commuting time, as well as their utility level, is necessary. For the latter, we apply a novel approach, taking reported subjective well-being as a proxy measure for utility. Both data are available in the German Socio-Economic Panel Study (GSOEP). The GSOEP is one of the most valuable data sets to study individual well-being over time. It was started in 1984 as a longitudinal survey of private households and persons in the Federal Republic of Germany and was extended to residents in the former German Democratic Republic in 1990. From this survey, we use the seven waves between 1985 and 1998 that contain information about individual commuting time. Observations for the seven waves are from all the samples

¹² See the substantial literature on reported subjective well-being, satisfaction and happiness in economics (e.g. Frey and Stutzer 2002a,b, Oswald 1997), as well as in psychology (e.g. Kahneman et al. 1999, Diener et al. 1999).

available in the scientific use file (samples A to F). People in the survey are asked a wide range of questions with regard to their socio-economic status and their demographic characteristics. Moreover, they report their commuting time and their subjective well-being. Commuting time is captured by the question “How long does it normally take you to go all the way from your home to your place of work using the most direct route (one way only)?” On average, people in the sample commute 23 minutes one way (or 46 minutes a day), with a standard deviation of 19 minutes. Median commuting time is 20 minutes. Commuters reporting journeys to work of one hour or more comprise 5.4 percent of the sample. Reported subjective well-being is based on the question “How satisfied are you with your life, all things considered?” Responses range on a scale from 0 “completely dissatisfied” to 10 “completely satisfied”. In order to study the effect of commuting on individual well-being, we restrict the sample to those who are actually commuting and who either report being employed or self-employed.

3. Visual Test and Econometric Estimations

The empirical test outlined is carried out in three stages and extends previous work on commuting and life satisfaction by Stutzer and Frey (2003). First, a visual test is provided in order to see whether individuals spending a lot of time commuting report, on average, the same or lower satisfaction scores than those with a relatively short commuting time. Second, a multiple regression approach is used to control for differences in observed characteristics, as well as unobserved idiosyncratic characteristics that are invariant over time. Third, since heterogeneity between subjects is predicted, we do separate analyses of the effect of commuting on life satisfaction for sub-samples: people who emphasize extrinsic life goals below or above certain thresholds.

Figure 1 provides a first visual test to see whether there are indications of any kind of a correlation between commuting time and people’s life satisfaction. Average life satisfaction is reported for the four quartiles of commuting time. Contrary to the prediction of $\beta=0$ in equilibrium, results indicate that there is a sizeable negative correlation between commuting time and individuals’ well-being. For each subsequent quartile of longer commuting time, we find, on average, a lower reported satisfaction with life. While life satisfaction is 7.24 points, on average, for people who commute 10 minutes or less (1st quartile), average satisfaction scores for the top 4th quartile (commuting time more than 30 minutes) is 7.00 points, i.e. 0.24 points lower.

[Figure 1 about here]

The raw correlation between commuting time and life satisfaction does not take into consideration that commuting time is likely to systematically differ for different groups of people. Thus, the observed lower subjective well-being of people who spend more time traveling from home to work might just reflect that these are people with different socio-demographic and socio-economic characteristics. In order to control for individual characteristics, a multiple regression approach needs to be applied.

Equation (4) is extended in order to include a set of individual covariates X_i

$$u_i = \alpha + \beta D_i + \gamma X_i + \varepsilon_i \quad (5)$$

It is important to note that X_i includes neither the respondents' labor income nor their household income. This is crucial, because income is one of the variables through which people are assumed to be compensated for their journey to and from work. Equation (5) only makes a sharp prediction of $\beta = 0$ if all channels for compensation remain uncontrolled.¹³

In table 1, equation (5) (the effect of commuting time on life satisfaction) is estimated in a pooled least squares regression, taking a large number of individual characteristics into account, as well as year dummies.¹⁴

[Table 1 about here]

Table 1 indicates that people spending more time commuting report much lower satisfaction with life, *ceteris paribus*.¹⁵ The effect is statistically highly significant and corroborates the

¹³ If income is kept constant, commuting time is expected to enter negatively by construction.

¹⁴ Here, only ordinary least squares estimations are reported. Thus it is implicitly assumed that the answers can be cardinally interpreted. While the ranking information in reported subjective well-being would require ordered probit or logit regressions, comparative analyses for GSOEP have shown that it makes virtually no difference whether responses are treated ordinally or cardinally (Ferrer-i-Carbonel and Frijters 2004). The 11 categories of the dependent variable seem to mitigate potential problems from assuming continuity.

¹⁵ A quadratic specification of the effect of commuting time on life satisfaction is chosen because we hypothesize that the marginal burden of commuting is falling. At least in the pooled estimation of table 1, this hypothesis is not rejected. The marginal burden of commuting is estimated to reach zero for a commuting time of 117 minutes.

findings in figure 1. People who spend one hour commuting one way report, on average, a 0.31 point lower subjective well-being than employed and self-employed people who choose not to commute (according to the first estimation in table 1). This finding is again at odds with the prediction of location theory and the implicit assumption in many economic models that, on average, people are compensated for commuting.

The control variables included in estimation 1 capture many observable differences between commuters.¹⁶ However, there are possibly unobserved personality traits that influence individuals' commuting behavior, as well as how they respond to questions on subjective well-being. However, idiosyncratic effects that are time-invariant can be controlled for if the same individuals are re-surveyed over time. This is the case for our longitudinal data set, in which it is possible to consider a specific baseline well-being for each individual. The statistical relationship between commuting and reported subjective well-being is then identified by the variation in commuting time within observations for the same person. In our sample, mean standard deviation of individual commuting experiences is 8.5 minutes.

The second estimation in table 1 reports the results for an estimation with individual fixed effects that excludes spurious correlation due to time-invariant unobserved characteristics of people. Partial correlations again show a sizeable negative effect of commuting time on life satisfaction. People who spend one hour commuting (one way) report, on average, a 0.16 point lower utility level. Thus the results of the raw correlation and the pooled estimation are confirmed.¹⁷ They do not support the standard equilibrium hypothesis that people, on average, are fully compensated for the costs of commuting. However, the results are consistent with our alternative hypothesis that misprediction of future utility leads people to accept jobs and housing that are not in their best interests. The compensation falls substantially short of the equilibrium prediction. Can it be calculated in terms of additional income what a commuter would have to earn in order to be as well off as somebody who does not commute? For this

¹⁶ A discussion of the results for the socio-demographic and socio-economic factors in Germany can be found in Stutzer and Frey (2004).

¹⁷ The two estimation approaches in table 1 lead to somewhat different results for the effect of commuting on subjective well-being. The partial correlation is larger in the pooled regression, which also includes information on variation between people. Potentially, this allows us to estimate the correlation between commuting time and subjective well-being more efficiently. In order to test whether the individual fixed effects are correlated with the explanatory variables, a Hausman test is performed. The hypothesis that there are no systematic differences in the coefficients between the fully efficient model in the first two columns and the less efficient fixed effect estimate in table 1,

analysis, a life satisfaction function is estimated that, in addition to the variables included in table 1, also includes the respondent's labor and household income, as well as the number of working hours (see appendix for a detailed description of the calculation).¹⁸ Full compensation for commuting one hour (one way), compared with no commuting, is estimated to require an additional monthly income of approximately 515 Euros or 40 percent of the average monthly wage.

There are, of course, important alternative explanations for commuters not being fully compensated. Market restrictions that increase transaction costs might affect the results because a sub-sample of the people surveyed are locked in sub-optimal situations. However, there seems to be no simple explanation. Estimating a fixed effect equation, equal to the one in table 1 for several sub-samples, shows no sizeable and statistically significant difference in the effect of commuting on life satisfaction between renters and house owners, between people with below and above median equivalence household income, and between people living in Western and Eastern Germany, the latter experiencing a much more liquid housing market. While disequilibrium models (or search models) are likely to explain part of the negative correlation between commuting and life satisfaction, we believe that they cannot account for the magnitude of the effect. Moreover, search models make no prediction about whether people with different intuitive theories about the sources of utility have more or less difficulties in optimizing their commuting behavior. The last test focuses on this heterogeneity between people.

If people have misguided theories about the sources of happiness, they are more likely to mispredict utility when they make decisions. We hypothesize that people with strong extrinsic orientation ("materialists") are more prone to making mistakes when predicting utility. People emphasizing extrinsic aspects as intuitive sources of well-being are identified *ex ante* in the survey. In two GSOEP waves, they were asked "How important for your well-being and satisfaction is ...?" They rated *inter alia* the following spheres of life: family, friends, income and a successful career on a four point scale from totally unimportant, not very important, important to very important. We define the first two spheres as intrinsic and the last two spheres as extrinsic. For each person in the sample, the relative importance of extrinsic over intrinsic spheres of life is calculated, whereby a cardinal scale is assumed. In order to test

however, is clearly rejected. The negative effect of commuting in the fixed effect model is thus more accurately measuring incomplete compensation.

¹⁸ The results of this estimation can be obtained from the authors upon request.

whether misprediction is greater for people who emphasize extrinsic spheres, we compare the effect of commuting across sub-samples. The effect of commuting on life satisfaction is estimated for people that are most intrinsically oriented (1st decile) and most extrinsically oriented (10th decile). For both sub-samples, the same equation is estimated as in table 1 with individual fixed effects.

Consistent with the alternative hypothesis, we find that people with intuitive theories of happiness, that strongly emphasize extrinsic rather than intrinsic aspects, experience a relatively larger negative effect of commuting time on their life satisfaction than the comparison group of the most intrinsically oriented people. Calculated for a commuting time of one hour one way, the effect is -0.0040 for the first group and -0.2277 for the second group.¹⁹ This indicates that strongly extrinsically oriented people are compensated less than people who emphasize intrinsic aspects to a greater extent.

The empirical test based on individual heterogeneity illustrates how an explanation based on the misprediction of utility can be differentiated from a residual explanation based, e.g., on transaction costs.

VI. Conclusions

This paper argues that individuals systematically mispredict the future utility of the goods consumed and activities undertaken. Goods and activities characterized by stronger intrinsic attributes (such as spending time with family and friends and pursuing hobbies) are undervalued compared to those characterized by stronger extrinsic attributes (such as most consumer goods). Due to the complexity of having to compare across various attributes, learning is slow and imperfect, so that the distorted decisions are preserved over time. As a consequence, individuals obtain a lower utility level than if they were not subject to this systematic bias of misprediction.

In an empirical application, individuals' commuting decisions are analyzed with data on subjective well-being. We find that people who spend more time commuting report lower life satisfaction, i.e. they are not fully compensated for the burden of commuting either by a

¹⁹ The estimated coefficient is -0.0013 ($t=-0.31$) for the first decile, while it is -0.0078 ($t=-1.61$) for the tenth decile. For the bottom and the top quartile, estimated coefficients are -0.0041 ($t=-1.39$) and -0.0051 ($t=-1.76$). If the sample is split at the median, for people as intrinsically oriented as the median person or more, a coefficient of -0.0030 ($t=-1.49$) is estimated, while the coefficient for people above the median is -0.0042 ($t=-2.01$).

higher salary, a better living environment or a lower rent. This is consistent with people overestimating future utility from extrinsic attributes of job offers and housing options and neglecting intrinsic attributes, like the physical burden of commuting and having less time available for spending with friends and family. In a refined analysis, the basic hypothesis is addressed, exploiting the variation in people's intuitive theories of happiness. It is studied as to whether people with extrinsically oriented life goals are more prone to mispredict utility. We find that the people who emphasize extrinsic life goals the most are compensated the least, and are therefore negatively affected by commuting.

The result that individuals are worse off according to their own best interests distinguishes us from the more traditional "consumption critique", according to which individuals are not able to choose what is best for them – but what is "best" is evaluated according to outside preferences.

Our analysis should not be a pretext to jump to the conclusion that government intervention is necessary or even advisable. It is very doubtful whether politicians and public officials have the insights, or the incentives, to be able to overcome this misprediction of future utilities. Moreover, at least some individuals may be able to resort to double-loop learning and establish self-binding rules for themselves, which help them to redress the balance in favor of goods and activities with strong intrinsic attributes over those with strong extrinsic attributes.

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Appendix

Calculation of the required amount of income to fully compensate commuters

How much additional income would a commuter have to earn in order to be as well off as somebody who is not commuting? The uncompensated costs of commuting in monetary terms can be calculated in three steps. First, the loss in utility is calculated due to incomplete compensation based on equation (5). Second, the marginal utility of additional income is estimated. Third, the ratio between the loss in utility due to commuting and the marginal utility of income is used to calculate the missing compensation in monetary terms.

The utility loss for a discrete change in commuting time based on equation (5) and the coefficients estimated in table 1 (second estimation) amounts to

$$\begin{aligned}\Delta U &= u(D = 60) - u(D = 0) \\ &= -3.65e^{-3} * 60 + 16.2e^{-6} * 60^2 - 0 \\ &= -0.161\end{aligned}$$

The marginal utility of income is estimated in a direct utility function. In order to estimate a coefficient for the gross marginal effect of additional income, a full specification is necessary that keeps important determinants of income constant. Here, commuting time and working time are controlled for, in addition to the covariates used in table 1. Income is measured in terms of the monthly net salary (w) and annual household income in 1,000 German Marks (h) (consisting of respondent's income as well as other household members' income k).²⁰

$$U = \alpha + \beta_1 D + \beta_2 D^2 + \gamma X + \delta_1 w + \delta_2 w^2 + \delta_3 \log y \quad \text{and} \quad y = 12(w + k)/1000$$

The marginal utility of additional labor income at the sample mean ($\bar{w} = 2569$, $\bar{h} = 64.103$) is

$$\begin{aligned}\frac{\partial u}{\partial w} &= \delta_1 + 2\delta_2 w + \delta_3 \frac{1}{y} \frac{12}{1000} \\ &= 0.14e^{-3} + 2 * -3.54e^{-9} * 2569 + 0.201 * 1/64.103 * 12/1000 \\ &= 0.16e^{-3}\end{aligned}$$

²⁰ If household income is excluded, a smaller coefficient for the marginal utility of income is estimated.

From the two previous results, the missing compensation can be calculated. Here, it is calculated for a commuter spending an hour to travel each way from home to work

$$\frac{\Delta U}{\partial u / \partial w} = \frac{-0.161}{0.16e^{-3}} = -1032.738$$

The additional compensation necessary for full compensation of a one hour commute thus amounts to 40 percent of labor income at the sample mean.

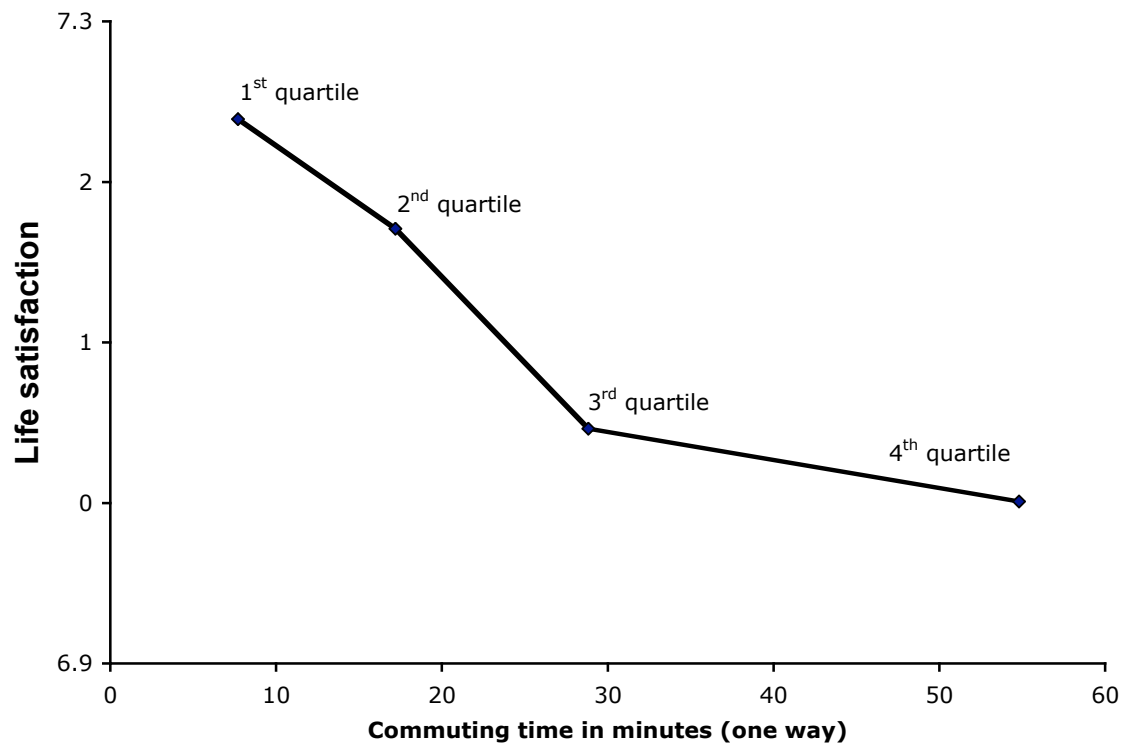


Fig. 1. Commuting time and average reported satisfaction with life, Germany 1985-1998

Data source: GSOEP.

Table 1
Commuting and satisfaction with life, Germany 1985-1998
Dependent variable: satisfaction with life

	OLS		OLS	
	pooled estimation		with individual fixed effects	
	Coefficient	t-value	Coefficient	t-value
Commuting time (in minutes)	-0.0070	-7.27	-0.0037	-2.55
Commuting time ²	0.030e-3	4.11	0.016e-3	1.67
Age	-0.052	-7.10		
Age ²	0.560e-3	6.32	-0.053e-3	-0.33
Male		Reference group		
Female	-0.040	-1.93		
Years of education, ln	0.446	8.32	-0.206	-0.59
No children		Reference group		
Children	-0.054	-1.72	-0.028	-0.68
Head of household or spouse		Reference group		
Child of head of household	0.297	4.73	0.076	0.77
Not child of head of household	0.019	0.18	0.026	0.12
Single, no partner		Reference group		
Single, with partner	0.252	4.49	0.130	1.64
Married	0.373	7.94	0.197	2.49
Separated, with partner	0.259	1.36	0.247	1.05
Separated, no partner	-0.388	-4.03	-0.292	-2.39
Divorced, with partner	0.332	3.97	0.542	4.17
Divorced, no partner	-0.286	-4.22	0.015	0.13
Widowed, with partner	0.409	2.22	0.296	0.91
Widowed, no partner	-0.206	-1.99	-0.347	-1.95
Spouse living abroad	-0.842	-4.48	-0.043	-0.15
No. of household members ^{1/2}	-0.030	-0.69	-0.048	-0.67
Employed		Reference group		
Self-employed	-0.235	-3.44	-0.020	-0.18
Western Germany		Reference group		
Eastern Germany	-0.715	-25.35	-0.403	-2.15
National		Reference group		
EU foreigner	0.196	5.17		
Other foreigner	-0.212	-6.11		
Year dummies	Yes		Yes	
Constant	7.278	129.82	7.392	55.57
Number of observations	27015		27015	

Data source: GSOEP.